Space Weather Technical Forecast

Issued on Friday 27 September 2024 at 13:09 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-flares (R1-R2 Blackouts). Chance of Active electron fluence Days 1-2 (27-28 Sep), then declining.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with the largest flare M1.4 at 26/2312 UTC from AR3839 on the southeast limb. The majority of regions on the disc at present are small and simple. The largest of these is AR3836, however the majority of this region is made of one polarity, with only very faint and small trailing positive polarity spots, which are gradually fading. AR3835 is currently the next largest but is a straightforward beta region with limited penumbra. The new region on the southeast limb has been numbered AR3839, and is difficult to assess due to foreshortening near the limb.

There were no Earth-directed CMEs observed. However a CME seen emerging towards the southeast is currently undergoing analysis, but is considered unlikely to be Earth-directed.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, showed a declining trend in the tail of the fast wind from CH72/+. Wind speeds eased from around 410 km/s to near 340 km/s. Density was below average. Interplanetary Magnetic Field, Bt, was weak below 7nT. The north-south component, Bz, was weakly variable but largely southward directed, ranging between +4/-7nT. Phi angle was mostly positive (away from the Sun). Geomagnetic activity was Unsettled (Kp 3) between 26/1200-1500 UTC, then Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 increased to predominantly moderate levels, briefly reaching high, peaking at 1113 pppc at 26/1505 UTC. The associated 24-hour fluence was below the Active threshold, but with an initial rising trend. The 27/0000 UTC observation was 3.63e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a chance of further isolated M-class flares.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs are currently expected. The current background solar winds are expected to persist until a possible weak enhancement occurs, from

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CH76/-, with wind speeds perhaps reaching around 450km/s. The fast wind onset is expected late on Day 2 or during Day 3 (28-29 Sep).

Mainly Quiet (Kp 0-2) geomagnetic conditions are expected for much of this period. The onset of any fast wind from CH76 could bring a spell of Unsettled to Active (Kp 3-4) intervals late on Day 2 into Day 3.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is forecast to persist at background levels. High energy electron flux at GOES16 is likely to remain at moderate, perhaps high levels, perhaps on a declining trend. The associated 24 hour fluence may rise a little Days 1-2 (27-28 Sep) with a chance of exceeding Active (1e8 integrated pfu), before likely declining into Days 3-4 (29-30 Sep).

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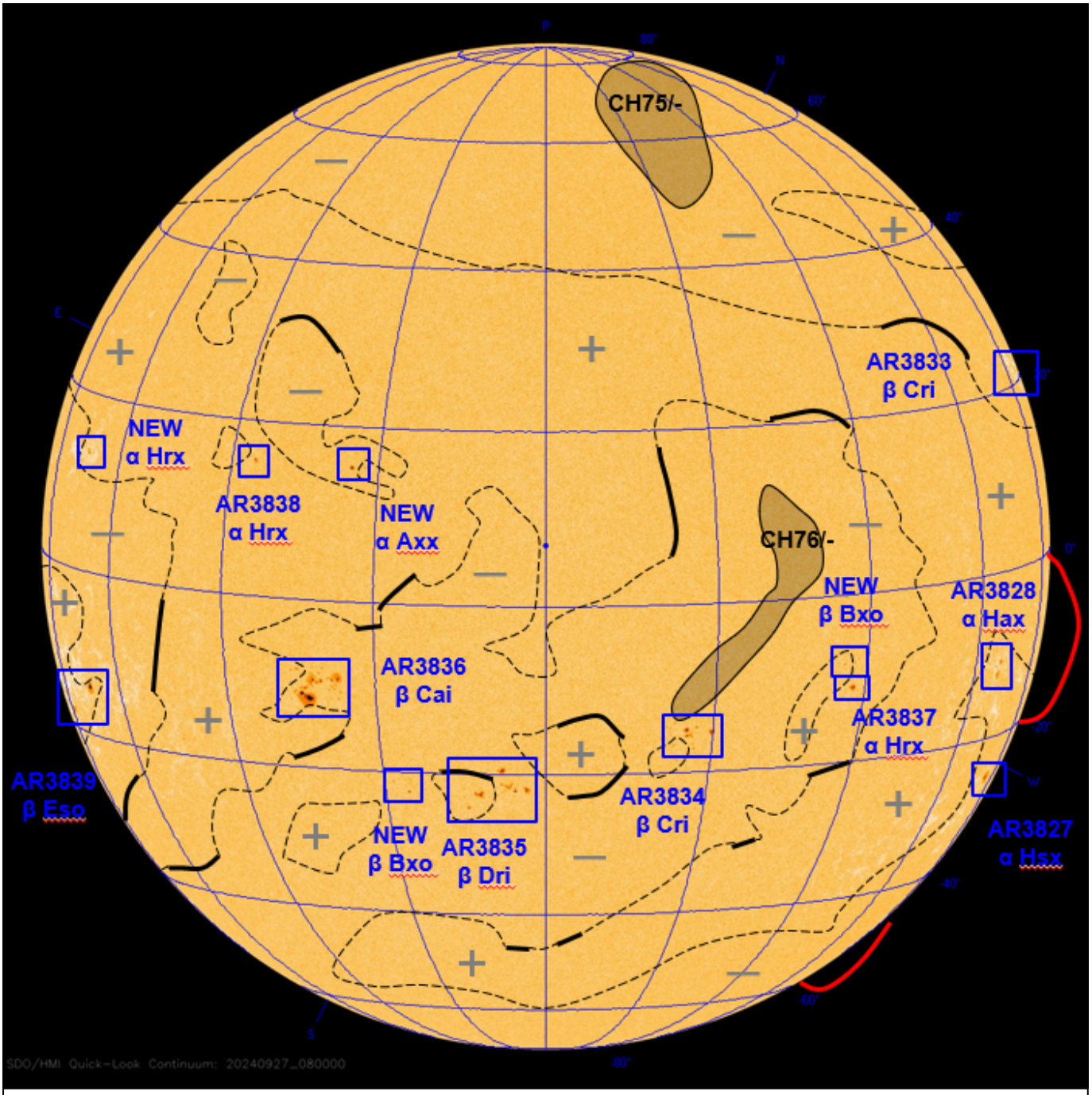
Figure 1: MOSWOC Solar Synoptic Map valid 27/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No Earth directed CMEs are currently expected.

The current background solar winds are expected to persist until a possible weak enhancement occurs, from CH76/-, a narrow coronal hole straddling the solar equator in the western hemisphere. This is a persistent feature which is little changed from the previous rotation, and only gave around 450km/s wind speeds previously, so similar is expected this time. As a negative polarity feature, the high speed stream (HSS) is not favoured for a strong connection at Earth so close to the September equinox. The HSS onset is expected late on Day 2 or during Day 3 (28-29 Sep). MOSWOC Enlil is indicating a strong HSS to develop during this period, but this is considered unlikely with no large coronal holes visible on the disc.

Mainly Quiet (Kp 0-2) geomagnetic conditions are expected for much of this period. The onset of any HSS from CH76 could bring a spell of Unsettled to Active (Kp 3-4) intervals late on Day 2 into Day 3.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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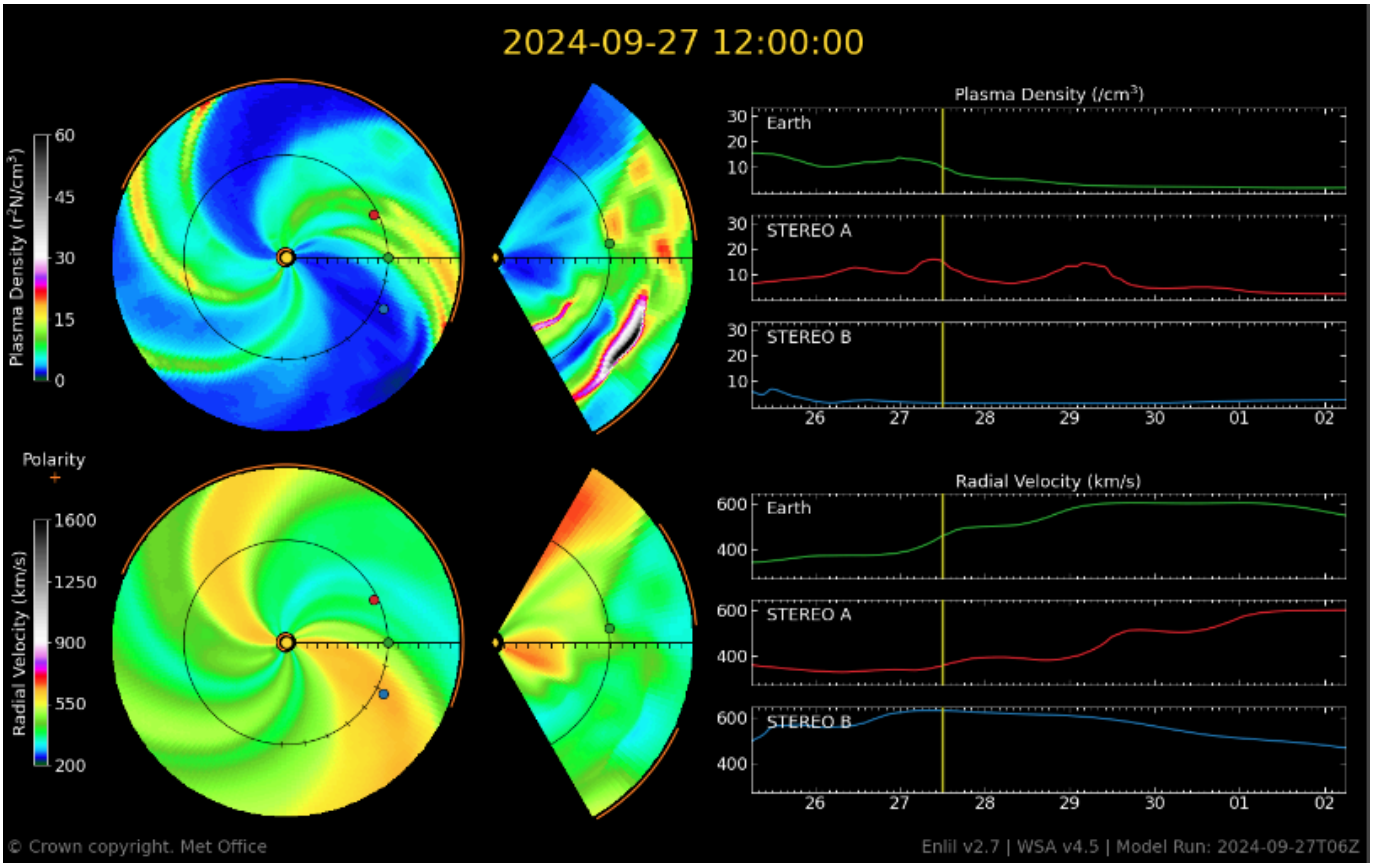
Figure 2: MOSWOC Enlil, showing a strong HSS developing later in the period which is currently considered unlikely.



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Radio Blackouts - X-Ray Flares

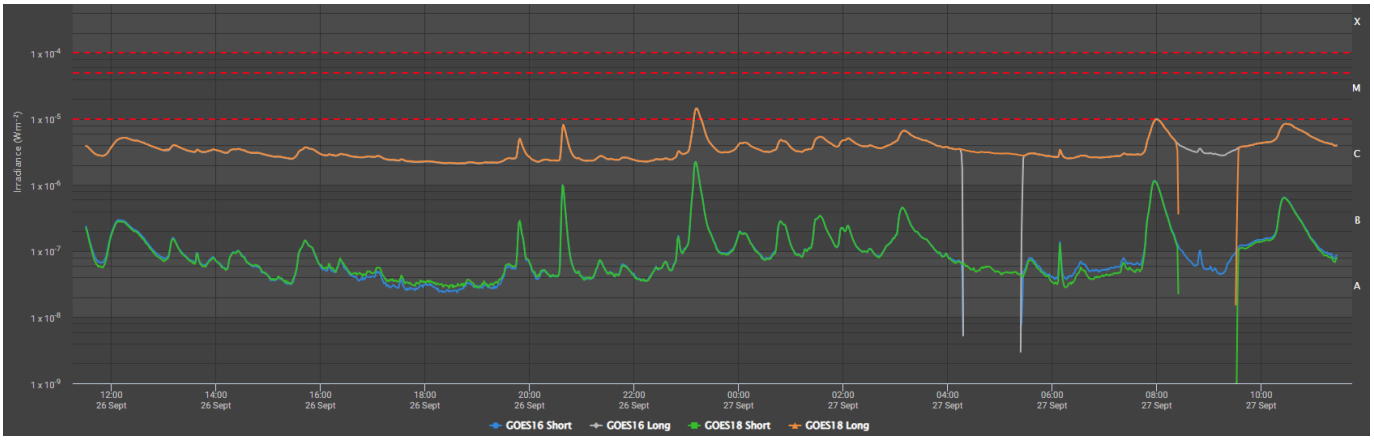
Solar activity has been Moderate with the largest flare M1.4 at 26/2312 UTC from AR3839 on the southeast limb.

The majority of regions on the disc at present are small and simple. The largest of these is AR3836, however the majority of this region is made of one polarity, with only very faint and small trailing positive polarity spots, which are gradually fading. AR3835 is currently the next largest but is a fairly straightforward beta region with limited penumbra. The new region on the southeast limb has been numbered AR3839, and is difficult to assess due to foreshortening near the limb. This region was responsible for the largest flare of the past 24 hours, although it was a very low level M-flare.

From far side soundings it is likely there are further regions to rotate onto the east limb, however until they become visible it is difficult to assess how much they are likely to affect solar activity. At the present time, Low to Moderate activity is expected with a a chance of further isolated M-class flares.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	50	50	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 3: X-ray flux at GOES16 and 18 in the last 24 hours, showing Low to Moderate activity.



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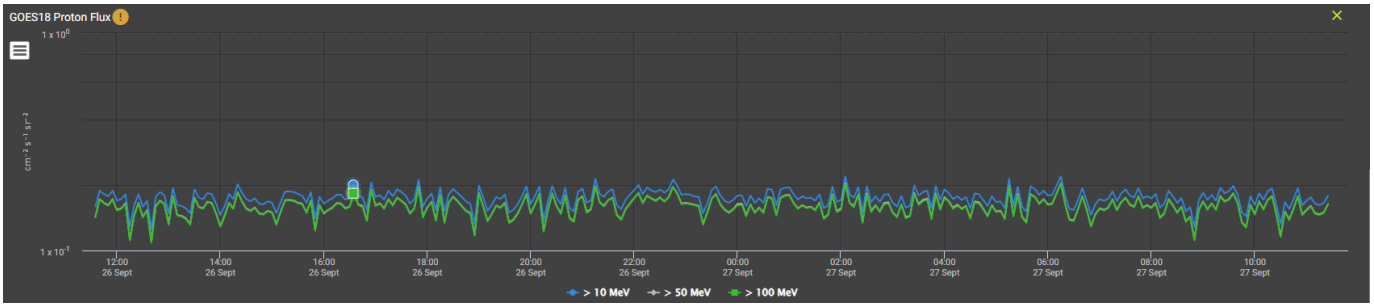
Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is forecast to persist at background levels, with only a very slight chance of rising above the S1/Minor Radiation Storm threshold.

The current visible sunspots are generally small and simple providing only modest contributions to flare risk, and are unlikely to significantly impact proton flux at Earth. However given the number of notable filaments currently on the disc, there is also a non-zero, albeit very low chance of observable protons should any significant filament eruption occur.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: X-ray flux at GOES18.



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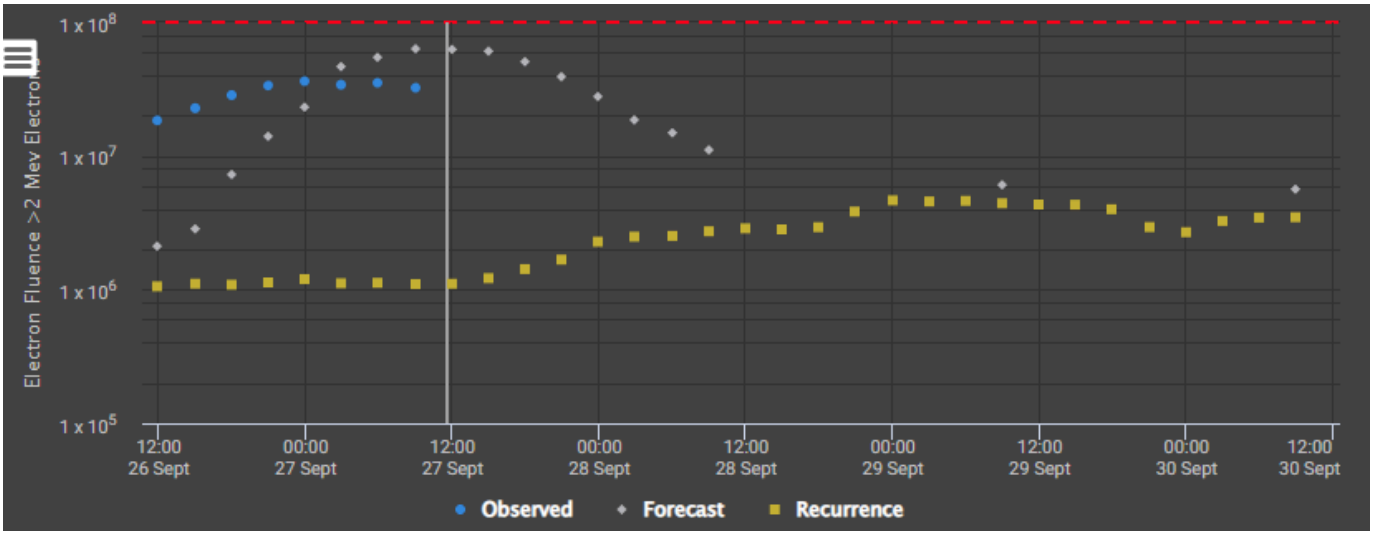
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) observed by GOES16 was at predominantly moderate levels over the past 24 hours, briefly touching high levels at yesterday's diurnal maximum. The recent HSS may have caused some increase in electron flux at lower orbits below GEO, and now the solar wind speed has eased there is the potential for a slight increase through the next day or so, but this is low confidence. However, any fast wind enhancement from CH76 also has the potential to suppress the observed flux during Days 2-3 (28-29 Sep).

The associated 24 hour fluence is currently below the Active threshold, with the recent rising trend now levelling off slightly. There is chance of fluence levels reaching Active, most likely on Days 1 and 2 (27-28 Sep). MOSWOC REFM, however, is now suggesting a declining trend. Confidence is low at this time, especially by Day 3 due to the likely weak HSS onset.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	25	30	20	10
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 5: MOSWOC REFM, now showing a declining trend.



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